OUR JUBILEE NUMBER.

PROLOGUE.

Fifty years have sped by since the Founder of this Magazine, the late J. W. Tutt, launched its first number into the Entomological world. It rapidly established its right to live, and it was not long before it became well known on the Continent and beyond the seas. The lamented death of its first Editor, in January of the year 1911, just after he had been elected to the Presidency of what is now the Royal Entomological Society of London, was a blow that was hard to recover from, but the panel of Editors succeeded in maintaining the standard set up by its Founder, and the *Entomologist's Record* now finds it way across the Atlantic and, in fact, nearly round the world. During its half-century of progress we have lost by death two other of its Editors, the Rev. C. R. N. Burrows and Dr Chapman, both of whom held positions that are still vacant.

In the present stress of life there seem to be fewer amateur entomologists than there were a generation ago, and we can only hope that this will rectify itself in the process of time, for it would be a thousand pities if the study of this branch of science were confined to professional entomologists only.—G. T. Bethune-Baker (Editor Emeritus).

FIFTY YEARS OF ENTOMOLOGY, 1888-1938.

By A. D. Imms, F.R.S.

The reader may be reminded that during the half-century covered by this short review entomology shed much of its obscurity and attained its present status and importance as a branch of zoology. Thus the fifty years of existence now heralded by the *Entomologist's Record* mark also a veritable jubilee of entomology itself.

Harking back to the year 1888, we are in a period when the progress of entomology in England was being upheld by the amateur. The names of Chapman, Godman, Lubbock, McLachlan, Merrifield, Sharp, and Verrall, to mention but a few, afford ample testimony. The leading, and almost the only, English text-book of the subject at that time was J. O. Westwood's "Introduction to the Modern Classification of Insects." Its two volumes had appeared as long previously as 1839-40, but their standard of excellence gave them a long lease of life.

The current teaching of entomology in England was of a perfunctory kind and was mostly limited to a few lectures in the general zoology course. Under the influence of T. H. Huxley, the type system of instruction in zoology had become established. This led to the adoption of the cockroach as representative of insects and, beyond an account of this creature, only a few generalities were imparted. Huxley's teachings inspired Miall and Denny to reinvestigate this type in some detail in their book "The Cockroach," which appeared in 1886. A new edition is now long overdue.

In the year 1888 there were no official economic entomologists in

England and the Board of Agriculture was as yet unestablished. It was mainly left to the private initiative of Miss Eleanor A. Ormerod to diffuse knowledge about injurious insects. Over in France Professor Brocchi, of the Institut Agronomique in Paris, dealt with any questions bearing upon economic entomology which the Ministère d'Agriculture referred to him. In the United States things were on a different footing; economic entomology was already well entrenched as a branch of agricultural activity. The names of Riley, Fitch, Hagen, Comstock, Packard, and Fernald are among those of luminaries of 1888—and they were all professional workers in the subject. Canada had its Department of Agriculture and had recently appointed James Fletcher as its entomologist and botanist.

It will be convenient to follow very briefly the development of some of the branches of entomology up to the present time. Text-books are "tools" of paramount importance; a sound work collating knowledge is an invaluable aid and a stimulus to progress. A fitting successor to Westwood's two volumes was David Sharp's treatise "Insects" in the Cambridge Natural History (1895-1899). Like Westwood, Sharp had published much on entomology before bringing out this work, which represents the fruits of much first-hand knowledge. Sharp's American contemporary, A. S. Packard, gave the world in 1898 the first book of comparative insect anatomy and physiology. His scholarly "Text-book" is among the best on insects which has emanated from the United States. It found a fitting successor in 1935 when R. E. Snodgrass published his "Principles of Insect Morphology." Two years earlier H. Weber had produced his "Lehrbuch der Entomologie"—a work of outstanding merit. In France L. F. Henneguy's "Les Insectes" was published in 1904, and in Italy the year 1909 saw the first volume of Antonio Berlese's "Gli Insetti"—an unsurpassed storehouse of facts replete with morphological and other detail. The extensive German "Handbuch" by Schroeder (1925-28), A. D. Imms' "General Text-book of Entomology," whose first edition came out in 1925, and J. H. Comstock's "Introduction to Entomology" are among the few other comprehensive books which have appeared. During much of the period under review the study of morphology has been paramount, but a significant change of viewpoint is evident to-day. A rapidly growing interest is being shown in insect physiology and a vast literature on this subject already exists; much of the older work is giving way to newer results based on greatly improved experimental technique. Words written in my 1937 address to the Royal Entomological Society of London on this subject may be fittingly quoted here.

"The applied entomologist in his efforts to find a surer foundation than purely empirical methods for the control of noxious insects, is devoting attention to the possibilities of insect physiology. He is realising that the most promising line of approach lies in a better knowledge of the inner working of insects themselves. The growing importance of insects as carriers of disease organisms of man and domestic animals is likewise creating a demand for similar knowledge. Applied entomology, therefore, as a whole, in its need for information of this kind, is focusing the attention of many workers on physiological problems. It needs also to be remembered that the rapid growth of the experimental viewpoint among general zoologists is another contribut-

ing influence, since an increasing number of zoologists is being attracted to the study of problems of a physiological nature afforded by the insect world. Already, more than one academic body has been led to provide for some measure of teaching and research in insect physiology. A very large literature on the subject in question is appearing in an extraordinary diversity of periodicals, many of which it has not been previously necessary to consult in connexion with entomology at all. The future burden of the worker in insect physiology of keeping pace with this literary growth seems likely to become increasingly difficult for this reason. One result from this increase in physiological knowledge seems to be that the morphologist will become better able to develop his subject, since it will be in the light of increased acquaintance with basic functions. Growth of physiological knowledge, also, is likely to involve the re-examination of many features of the minute structure of insects, with possibilities of interpretations being made from another angle of vision. In connexion with the foregoing remarks, reference needs to be made to an introductory manual of insect physiology by V. B. Wigglesworth, published in 1934. It formulates what is virtually a new subject and co-ordinates much scattered information, not readily accessible, or easily evaluated."

Among the more important achievements in insect physiology may be included A. Krogh's demonstration in 1920 of the significance of the physical process of diffusion in respiration. Also, the discoveries by various experimentalists of the presence in insects of what are comparable with the endocrine organs of vertebrates are noteworthy. We are beginning to realise that the influences governing moulting, metamorphosis and the proper growth of the gonads are internal secretions. Since such secretions are discharged into the blood they are comparable with hormones of the endocrine type. We have evidence that the small paired bodies known as corpora allata, in association with the sympathetic nervous system, just behind the brain, are endocrine organs and the seat of, at any rate, some of the secretions involved. Several recent workers in Germany have studied the physiology of colour change in the common stick insect, *Carausius morosus*. This creature is able to alter its general coloration in response to sudden changes in its surroundings, becoming dark or pale as the case may be. The response is effected by movements of pigment in the integument cells. The primary sensation of the background colour is received by the eyes from which an impulse is transmitted to the brain and induces the secretion of a hormone into the blood. Mention needs also to be made of Wigglesworth's suggestive work (1932) on the functions of the rectal glands which have long remained an unsolved problem. This experimenter brings forward evidence that the function of these organs is the absorption of water from the excrement and in this way facilitating its conservation when necessary. In sense physiology the life-long studies of von Frisch on the behaviour of the hive-bee are familiar to many while a new approach towards the solution of the functions of sensory receptors is being made by modern workers in Cambridge by isolating such organs from the rest of the nervous system. Sensory impulses in the nerves are recorded by means of an amplifier and Matthews oscillograph. By this means Pringle, a short while ago, showed that the campaniform organs (or so-called " olfactory pores ") are not olfactory as usually

thought but function as "stress receptors," registering tensions and strains in the cuticular skeleton at the joints.

In other fields the great problems of evolution, natural selection and adaptive coloration have attracted wide interest. In these connections no name is better known than that of Sir Edward Poulton whose labours have extended continuously through the half century under review, up to the present time. W. M. Wheeler, of Harvard University, brought rare acumen and philosophic insight to bear in interpreting the origins and evolution of social behaviour in insects. P. Marchal in 1904 and F. Silvestri in 1906 made fundamental discoveries on polyembryony, elucidating its essential features and bringing to light one of the most remarkable of biological phenomena. The abilities of Silvestri enabled him to cover a wider field of research than any of his contemporaries. With his name is associated the discovery of the only two new orders of insects brought to light for many years. In the Protura and Zoraptera are minute forms of more than ordinary interest. The name of J. Pantel must be included among the outstanding investigators of the period. His splendid studies of the life-cycles and host-relations of Tachinid flies broke much new ground between 1898 and 1910. Among very recent advances the phase theory of locusts, so closely associated with the name of B. P. Uvarov, is of far-reaching significance. J. C. Faure and others have established Uvarov's contentions on both biological and morphological grounds. The whole phase idea has proved a fertile stimulus to research along diverse lines. The names of other outstanding workers, who have contributed to the advance of fundamental knowledge of insects, must be passed over owing to the exigencies of space.

Passing now to taxonomy we find that to-day, just as fifty years ago, this branch of entomology claims more devotees than any other aspect of the subject. Its home is in the great museums of the world—but outside these walls it is very little fostered by universities but still has a large following among non-professional workers. The international code of nomenclature as we know it to-day did not exist until 1889 when the parasitologist, R. Blanchard, initiated the beginnings of the present system which was brought forward at the First International Zoological Congress at Paris. Fifty years of taxonomy have witnessed an enormous addition in the number of descriptions of genera and species of insects. Taking the single order Coleoptera it will be remembered that between 1868 and 1876 Gemminger and Herold were able to catalogue the 77,000 species of this order in twelve volumes. Over 60 years later when a new catalogue of the world's species came to be compiled it was found to require 30 volumes and about 40 collaborators to list 240,000 species. The accumulations of described genera and species in all the major orders of insects seem to be growing too unwieldy for that essential stock-taking process known as monographing except as family or lesser units. We may ask whether Seitz's Lepidoptera and Lindner's "Palaearctic Diptera," with their numerous collaborators, will be the last of their kind. Both works have overtaxed the financial resources of some libraries in endeavouring to keep pace with their issues. The rapid growth of applied entomology has led to an enormous demand from all over the world for the services of the taxonomist. The naming of material is often of urgency and it may

as often as not entail the description of new species and genera. As S. A. Neave has pointed out, in his 1936 address to the Royal Entomological Society of London, these demands are quite impossible of satisfaction with the existing staffs of museums and kindred bodies. The outcome of this situation will be a slowing down of entomological progress unless the means are forthcoming for providing for the services of many more systematists.

The growth of knowledge of insect life of past ages would require a long article to do it justice. A definite landmark in insect palaeontology was the appearance in 1908 of the great volume of Anton Handlirsch entitled "Fossilen Insekten." This work collated and reviewed all that was known on the subject up to that time. After an interval unmarked by much progress the last fifteen years have proved extraordinarily fertile in new palaeontological discoveries, especially from rocks of Permian and Triassic ages. Largely through the energies of R. J. Tillyard, A. B. Martynov, and F. M. Carpenter, whole faunas of insect life of the past have been disclosed; strata hitherto unproductive of insect remains have proved remarkably rich; new orders have come to light and the ancestry of many existing groups traced back into remote ages.

The well-known discovery of Sir (then Major) Ronald Ross in 1897 of the carriage of the malarian parasite by *Anopheles* mosquitoes was the forerunner of a long series of later discoveries by many workers. Thus the great importance of insect-borne diseases in the Tropics came to be recognised. Schools of tropical medicine, each with teachers of medical entomology, were established at Liverpool and at London. The German Government later established a similar institution at Hamburg. Among other schools of this type must be included those at Harvard and other Universities in the United States and the Oswaldo Cruz Institute in Rio de Janeiro.

Another important event was the establishment of the Entomological Research Committee (Tropical Africa) in 1909 which was the forerunner of the present Imperial Institute of Entomology. The importance of this Institute not only to the British Empire but also to the whole world wherever entomology is concerned is well known. Another official organisation of great importance is the U.S. Bureau of Entomology which has more entomologists under its jurisdiction than are employed in the whole of the British Empire. The rise of this Bureau can be traced back to 1894 when L. O. Howard became chief of the Division of Entomology as it was then called. Under his wise and broadminded guidance and control it has risen to its present position of commanding importance. Dr Howard has the good wishes of the whole world of entomology in his retirement which took place a few years ago.

The introduction in 1889 of *Vedalia cardinalis* into California, in order to repress the cottony cushion scale, resulted in the first conclusive example of the biological control of an injurious insect. The success achieved as the result of this project led to a rapid application of the principle upon which it is founded to other countries. The striking results achieved in the Hawaiian Islands and very recently in Fiji, in combating various pests by biological means, rank as one of the most interesting chapters in applied biology.

Between 1889 and 1895 a number of government entomologists were

appointed in different parts of the British Empire but it was not until 1912 that the English Board of Agriculture, as it then was, appointed its own entomologist. To-day there are between 300 and 400 professional entomologists in the Empire. The Great War proved a real stimulus for the furtherance of the applied sciences including improved methods in agriculture. These in their turn resulted in an increased demand for trained men. In the case of entomologists the demand for the services of trained men outstripped the supply. Furthermore, the universities and colleges had neither the staff nor the laboratory equipment for the proper training in methods and research. Matters improved a good deal and now most universities make provision for at least some advanced entomological teaching. At the present time the demand for trained entomologists has very noticeably declined. Most of the existing appointments are filled by relatively young men: the economy campaign which came as a repercussion of post-war extravagance resulted in the closing down of a number of posts while allocations for new work were cut down all round. This state of affairs has persisted to a considerable degree ever since, and, coupled with the general uncertainty in international affairs, has left the outlook for entomology as a profession in a rather unpromising phase.

Possibly one of the most convincing methods of estimating the growth of a subject like entomology is by comparison of the contents of the yearly volumes of the Zoological Record. Thus, in the volume for 1888, the titles of 941 entomological papers are listed whereas that for the year 1936 (the most recent available volume) has the titles of 3725 papers entered. These figures speak eloquently for themselves. It is also noteworthy that, with the exception of the publications of certain old-established entomological societies, almost all the leading entomological journals are considerably younger than the *Entomologist's Record*, in fact very few date before the year 1900. The number of new entomological journals multiplies annually, without attempts to concentrate efforts on an individual group or subject, and consequently the burden of searching the literature is an ever increasing one. Even during the short period 1934-1936 no fewer than fifteen new periodicals devoted to entomology were launched. It is true that one is already defunct while some others seem little likely to survive on their intrinsic merits—nevertheless, the " residue " represents a substantial addition to periodical literature for so short a time. It is, on the other hand, to be regarded as an expression of vitality and of the importance of the subject in connection with human affairs.

This rather disjointed expression of personal views and impressions is concluded with congratulations to an old friend in the person of the " Editor Emeritus," G. T. Bethune-Baker, and to those others associated with the production of the *Entomologist's Record*.

The Editors much desire to obtain for each number:—Short items of entomological news, short notes on collecting results, and on results at dusking, sugar and light, unusual occurrence, and short observations. Readers are favourably disposed to such. Especially do we want notes from our microcollectors, and we would like to see more records of Diptera.